

# 1985

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## **Sakigake**

Nation: Japan (1)

Objective(s): Halley's Comet flyby

Spacecraft: MS-T5

Spacecraft Mass: 138.1 kg

Mission Design and Management: ISAS

Launch Vehicle: Mu-3S-II (no. 1)

Launch Date and Time: 7 January 1985 /  
19:26 UT

Launch Site: Kagoshima / launch complex M1

Scientific Instruments:

- 1) solar wind ion detector
- 2) plasma wave probe
- 3) magnetometer

**Results:** The MS-T5 spacecraft (named Sakigake after launch) was the first deep space spacecraft launched by any country apart from the Soviet Union and the United States (the two German Helios probes had been launched by NASA). Japan's goal had been to launch a single modest probe to fly past Halley. As part of a test to prove out the technologies and mission operations of the actual mission, the country's Institute of Space and Astronautical Sciences (ISAS) launched this test spacecraft known as MS-T5, nearly identical to the "actual" vehicle launched later. The spin-stabilized spacecraft was launched by a new Japanese launch vehicle, the Mu-3S-II. Following two course corrections on 10 January and 14 February

1985, Sakigake was sent on a long-range encounter (about 7.6 million kilometers) with Halley. The spacecraft served as a reference vehicle to permit scientists to eliminate Earth atmospheric and ionospheric contributions to the variations in Giotto's transmissions from within the coma. The spacecraft's closest approach to Halley was at 04:18 UT on 11 March 1986, when it was 6.99 million kilometers from the comet. Nearly six years after the Halley encounter, Sakigake flew by Earth on 8 January 1992 at a range of 88,790 kilometers. After two more distant flybys through Earth's magnetic tail (in June 1993 and July 1994), Sakigake maintained weekly contact with the ground until telemetry was lost on 15 November 1995, although the ground continued to receive a beacon signal until all contact was terminated on 7 January 1999.

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## **Giotto**

Organization: European Space Agency (1)

Objective(s): Halley's Comet flyby

Spacecraft: Giotto

Spacecraft Mass: 960 kg

Mission Design and Management: ESA

Launch Vehicle: Ariane 1 (V14)

Launch Date and Time: 2 July 1985 /  
11:23:16 UT

Launch Site: Kourou / ELA-1

**Scientific Instruments:**

- 1) neutral mass spectrometer
- 2) ion mass spectrometer
- 3) dust mass spectrometer
- 4) dust impact detector system
- 5) plasma analysis 1 experiment
- 6) plasma analysis 2 experiment
- 7) energetic-particle analyzer
- 8) magnetometer
- 9) optical probe experiment
- 10) color imaging system

**Results:** Giotto was the first deep space probe launched by the European Space Agency (ESA). Because the cylindrical spacecraft was designed to approach closer to Halley than any other probe, it was equipped with two dust shields separated by 23 centimeters; the first would bear the shock of impact and spread the impact energy over larger areas of the second, thicker rear sheet. The design of the spacecraft was based on the spin-stabilized magnetospheric Geos satellites launched in 1977 and 1978. After course corrections on 26 August 1985, 12 February 1986, and 12 March 1986, Giotto was put on a 500-kilometer flyby to the comet's core. Data on its trajectory was based upon tracking information from the Soviet Vega 1 and 2 probes. The spacecraft eventually passed by Halley on 14 March 1986. Closest encounter was at a range of 605 kilometers at 00:03:02 UT. At a range of 137.6 million kilometers from Earth, just 2 seconds before closest approach, telemetry stopped due to impact with a heavy concentration of dust that probably knocked the spacecraft's high-gain antenna out of alignment with Earth. Fortunately, data transmission was restored within 32 minutes. On average, Giotto had been hit 100 times a second by particles weighing up to 0.001 grams. By the end of its encounter with Halley, the spacecraft was covered in at least 26 kilograms of dust. Giotto returned 2,000 images of Halley. After the encounter, ESA decided to redirect the vehicle for a flyby of Earth. The spacecraft was officially put in hibernation mode on 2 April 1986. Course corrections on 19 March, 20 March, and 21 March 1986, however, set it on a 22,000-kilometer flyby of Earth on 2 July 1990 for a gravity-assist (the first time that Earth had been used for such a purpose) to visit a new target: Giotto successfully flew by

Comet Grigg-Skjellerup at 15:30 UT on 10 July 1992 at range of approximately 200 kilometers. Eight experiments provided extensive data on a wide variety of cometary phenomena during this closest ever flyby of a comet. After formal termination of the encounter on 23 July 1992, Giotto was put in hibernation. In September 1999, ESA scientists revealed that a second comet or cometary fragment may have been accompanying Grigg-Skjellerup during the encounter in 1992. The spacecraft repeated a flyby of Earth at 02:40 UT on 1 July 1999 at range of 219,000 kilometers.

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**Suisei**

**Nation:** Japan (2)

**Objective(s):** Halley's Comet flyby

**Spacecraft:** Planet-A

**Spacecraft Mass:** 139.5 kg

**Mission Design and Management:** ISAS

**Launch Vehicle:** Mu-3S-II (no. 2)

**Launch Date and Time:** 18 August 1985 / 23:33 UT

**Launch Site:** Kagoshima / launch complex M1

**Scientific Instruments:**

- 1) ultraviolet imaging system
- 2) solar wind experiment

**Results:** Planet-A (named Suisei after launch), was the second of two Japanese probes launched towards Halley during the 1986 encounter. The cylindrical spacecraft was launched directly on a deep space trajectory without entering intermediate-Earth orbit. The main payload of the spacecraft was an ultraviolet-based imaging system that could study the huge hydrogen corona around the comet. After a course correction on 14 November 1985, Suisei flew within 152,400 kilometers of the comet's nucleus on 8 March 1986 at 13:06 UT, returning ultraviolet images of the 20-million-kilometer-diameter hydrogen gas coma. Even at that relatively large distance from the comet, the spacecraft was hit by at least two dust particles, each 1 millimeter in diameter. After the Halley Encounter, in 1987, ISAS decided to send the spacecraft through an elaborate trajectory for an encounter with the Comet Giacobini-Zinner on 24 November 1998, thirteen years after launch. Suisei performed a series of trajectory corrections between 5 and

10 April 1987 in order to send it on a gravity-assist around Earth on 20 August 1992 at a range of 60,000 kilometers. Unfortunately, hydrazine for further corrections had been depleted by 22 February 1991. The planned

encounter with Giacobini-Zinner (as well as a far-distance flyby of Comet Tempel-Tuttle) had to be canceled on 28 February 1998; the cancellation formally ended the mission.